DOCUMENT RESUME

ED 152 538 SE 024 051

AUTHOR Schlenker, Richard M.
TITLE Introduction to Physics (Mechanics): A Semi-Self Paced Approach.
PUB DATE Jan 78
NOTE 39p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *College Science; Higher Education; Individualized Instruction; *Mechanics (Physics); *Physics; *Science Courses; Science Education; Science Instruction; *Science Units

ABSTRACT

Presented is a guide for an introductory college level physics course in mechanics. The course is contract graded and allows students to proceed at their own pace; however, lectures, problem solving sessions, and laboratory sessions are included. Students on an independent basis review video tapes, film loops, library study, and conduct an independent study project. Examinations may be retaken, and a grade of at least 70% is required before students are allowed to proceed with further course material. (SL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED152538

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

INTRODUCTION TO PHYSICS (MECHANICS): A SEMI-SELF PACED APPROACH

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Richard Schlenker

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

BY

RICHARD M. SCHLENKER
DEPARTMENT OF ARTS AND SCIENCES
MAINE MARITIME ACADEMY
CASTINE, MAINE
JANUARY 1978

SE 024 057

ABSTRACT

This is an introductory college level course in mechanics. It is graded by contract and within certain limits, allows the student to work at his own rate. The student studies and learns relevant course material by attending lectures, problem solving sessions, and laboratory sessions. The student also, on an independent basis, views video tapes, film loops, pursues library study, and conducts independent study projects. There are several examinations which measure student competencies. These examinations may be taken more than once; however, the student must obtain a grade of at least 70% before he is judged to have reached minimum competency with a block of material.

INTRODUCTION

Introduction to Physics (PS-1) is a competency based contract graded course. It affords the student the chance to work at his own rate and in turn allows the student the chance to decide upon the competency level which he wishes to attain. Further, it allows students to achieve to the same competency levels regardless of their learning rates. The students are cautioned, however, since the slower the student's learning rate, the more time he must invest in order to achieve a given competency level.

According to this scheme the student decides the competency level for which he wishes to work, then contracts to achieve that level by picking the grade which reflects that level. Once he has successfully attained that level, his work with the course is complete. This level may be attained early in the course. On the other hand, the student may take the entire semester to attain the desired competency level.

COURSE COVERAGE

The course deals with the mechanics section of the text. It is this section to which the student must attend and apply the majority of his efforts.

Specifically, the course deals with Chapter 1, Physics and Measurement; 2, Vector Quantities; 3, Systems of Forces; 4, Torque and Equilibrium; 5, Translational Motion; 6, Force and Motion, 7, Work and Energy; 8, Momentum; 9, Uniform Circular Motion and Gravitation; 10, Elasticity and Harmonic Motion; 12, Fluids at Rest; and 13, Fluids in Motion.

The majority of the inclass time and laboratory time will be spent dealing with Chapters 1 through 8 and it is around these chapters that the lectures and problem solving sessions revolve.

The text is the primary source of information. The primary source is supplemented by films, video tapes, lectures, laboratory sessions, and problem solving sessions.

COURSE OBJECTIVES

1. The primary objective of the course is to provide the student with the requisite skills so that he will be able to deal with problems and problem situations related to physics and measurement, vector quantities, systems of forces, torque and equilibrium, translation motion, force and motion, work and energy, and momentum.
2. The two secondary objectives are as follows:
   A. To provide the students with a background in the areas of uniform circular motion and gravity, and elasticity and harmonic motion.
   B. To provide the students with a background in the areas of fluids at rest, fluids in motion, and in addition, to provide experience studying the application of physics principles to shipboard situations.

GOALS

As a result of his study in this course, the student should be able to apply the principles of mechanics to shipboard situations.

EXAMINATIONS

The course has six examinations. They cover the relevant subject material as follows:

EXAMINATION	1	Physics and Measurement; Vector Quantities
	2	Systems of Forces; Torque and Equilibrium
	3	Translational Motion; Force and Motion
	4	Work and Energy; Momentum
	5	Uniform Circular Motion and Gravitation; Elasticity and Harmonic Motion
	6	Fluids at Rest, Fluids in Motion

In order to successfully pass these examinations, the student must answer at least 70% of the examination questions correctly. Further, an examination over a given block of material may be taken more than once.

All examinations are administered on an individual basis. Whenever the student feels he is ready to take an examination he contacts the instructor and arranges a time when the exam can be taken.

COURSE GRADING

The course grade is determined by contract. That is, the student decides the competency level he wishes to attain and then contracts to do the work required of the respective level.

To attain a grade of C for the course, the student must take and successfully pass examinations 1 through 4 and successfully complete all laboratory work.

A grade of D will be awarded in all cases where the student fails to attain a grade of 70% on any one of the four required C level examinations (the student may take the examination more than

once in an attempt to attain the 70% level) or fails to successfully complete all laboratory work.

A grade of B will be awarded for successfull completion of examinations 1 through 5, and successful completion of the required laboratory work.

A student who wishes to attain the A competency level (A course grade) must successfully complete examinations 1 through 6 with a score of at least 70% or better. In addition, the A level student must complete all required laboratory work and submit an acceptable report dealing with the application of mechanical principles to shipboard applications.

The A level project requires the student to report upon at least three applications of physics principles to shipboard deck functions. These reports should revolve around situations which actually exist on the Training Vessel, State of Maine. The subject matter for all reports must be approved prior to the student's beginning the report.

The A level reports should use the following format:

INTRODUCTION
This section includes the objectives of the writer, i.e., why was the project undertaken.

METHODS
This section tells the reader how the investigation was conducted.

DATA
This section contains the information which was collected. It may be presented in properly labeled charts, graphs, tables, etc.

DISCUSSION
In this section the author discusses the data which has been collected. It may be compared with accepted theory and the current state of knowledge in the field.

CONCLUSIONS
This section includes conclusions based upon the data which was collected and the comparison of that data with theory and the current state of the art.

REFERENCES
In this section, the author cites any reference from which information for the report was taken.

The reports should be written in the third person, past tense. Remember, this is the report of an investigation which has already taken place.

COURSE CONDUCT

The course inclass time will consist of ten lecture and ten problem solving sessions. These twenty sessions will deal specifically with the material covered in text chapters 1 through 8. The remainder of the scheduled class time will be devoted to testing sessions, student projects, student time to view video-tapes and other films, and time for students to conduct library study.

Laboratory Sessions: Laboratory sessions will be held once each week for a period of two hours. The class will be divided in half so that half of the class will participate in an organized laboratory activity each week. Those students who are not engaged in a laboratory session during a given week are encouraged to use the time for library study related to physics.

Problem Sets: There is a problem set for each of the chapters. They are included in the appendix. The purpose of these sets is to guide the student in his study of the phenomena contained in the various chapters. In addition, they should prepare the student for the several examinations.

Problem sets will not be collected or graded. However, it is the individual student's obligation to attend to these sets.

Students should solve the problems at the end of each chapter in their text. Specifically, the odd numbered problems should be solved in a stepwise manner.

Problem solving sessions will be devoted to solving type problems. Each individual problem will not be solved.

Lectures: The material for the lectures will be drawn from the student text, Smith A.W., and Cooper, J.N., Elements of Physics. Eighth Edition. McGraw-Hill Book Company: New York, 1972. Material for the lectures will also be drawn from those texts listed in the bibliography section. All of the texts listed in the bibliography are on reserve in the library.

Lecture material is further amplified and supported by film strips. Those film strips and tapes are listed in the appendix with each problem set. Students are not obligated to view these films; however, material from them may be incorporated as lecture material.

Each lecture will cover approximately one chapter. At the completion of the ten lectures, the first eight chapters will have been covered.

Problem Solving Sessions: The problem solving sessions, as previously mentioned, will be devoted to solving type problems. Generally, a problem solving session will follow each lecture. Problems solved during a given session will be related to the lecture material immediately preceeding the problem session.

Testing Sessions: Testing sessions will be held during the normal lecture time. The frequency of these sessions will be approximately one every two weeks. Students may elect to take or not to take an examination at a given testing session. If he elects not to take a test at one of these sessions, he need not be present at the session. The only obligation is that the student meet his contract by the end of the semester.

BIBLIOGRAPHY

The texts listed in this section are on reserve in the library. These texts are available for student use during normal library hours. Portions of the lectures are taken from these texts.

1. Ashby, N. and Miller, S.C., Principles of Physics, a Programmed Approach. Boston: Allyn and Bacon, 1966.
2. Alkins, K.R., Physics Once Over Lightly, New York: Wiley, 1972.
3. Bennett, C.E., First Year College Physics. Orono, Maine, 1952-53.
4. Bennett, C.E., Physics Withough Mathematics. New York: Barnes & Noble, 1954.
5. Borowitz. S., and Barnstein. L.A., A Contemporary View of Elementary Physics. New York: McGraw-Hill, 1968.
6. Brinckerhoff, R.F., and Cross, J.B., Exploring Physics. New York: Harcourt Brace, 1959.
7. Cooper, L.N., An Introduction to The Meaning and Structure of Physics. New York: Harper & Row, 1968.
8. Edwards, S., Physics: A Discovery Approach. New York: Wiley, 1971.
9. Freeman, I.M., Physics; Principles and Insights. New York: McGraw-Hill, 1968.
10. Harvard Project Physics, The Project Physics Course; Readers. New York: Holt, Rinehard and Winston, 1971.

11. Highsmith, P.E., and Howard, A.S., Adventures in Physics. Philadelphia: Saunders, 1972.

12. Inglis, S.J., Physics: Ebb and Flow of Ideas. New York, 1970.

13. Read, A.J., Physics: A Descriptive Analysis. Reading, Mass.: Addison- Wesley, 1970.

14. Pipley, J.A., The Elements and Structure of the Physical Sciences. New York: Wiley, 1964.

15. Pettofrezzo, A.J., Vectors and their Applications. Englewood Cliffs, N.J.: 1966.

APPENDIX A

PROBLEM SETS

CHAPTER 1 PROBLEM SET

1. In what units is length measured?

2. In what units is mass measured?

3. Name two principal advantages of the metric system.

4. In what unit is time measured?

5. What are some of the convenient relationships between the various units of length?

6. The record for a mile run is 3:51 minutes. What would you expect to be the record time for 1500 meters?

7. A man, by mistake, measures the area of his plot of land as 2000 m^2 using a yardstick, thinking it to be a meter stick. What was the correct area?

8. A ship travels 15 knots per hour for three hours, then 20 knots per hour for 7 hours. What was the average speed of the vessel for the period it was underway?

9. What are the dimensions of density?

10. The density of sea water is 1.022 g/cc. What is the mass of a sample of one cubic meter?

11. What is the volume in meters of a cube which is 100 centimeters on a side?

12. How many degrees F is 285°K (Kelvin)?

13. If there are 2π radians in a circle, one radian is equivalent to how many degrees?

14. How many cubic millimeters are there in a cubic meter?

15. Define force.

16. Convert 54 miles per hour into inches per second.

17. If one wave length is equivalent to one cycle, how many wavelengths will one find in a system which reports 60 cycles per second and has been operating for 60 seconds?

18. A ship is travelling at 15 statute miles per hour. How many knots is it travelling?

19. A ship weighs a 1000 tons. How many kilograms does the ship weigh?

20. What is a newton and how is it related to the pound, milligram, gram, and kilogram?

CHAPTER 1 FILMS

These films are available in the Academy Library. They may be viewed there or by contacting the AV Center Director.

1. Film Loop #85, Density of Fluids.

CHAPTER 2 PROBLEM SET

1. Define resultant vector.

2. What is a vector quantity?

3. How is $C^2 = a^2 + b^2$ related to vectors?

4. A ship steams 12 nautical miles from its home port and then turns such that the angle between the first leg and the second leg of the voyage was 127°. The ship then steams 25 nautical miles. After having travelled for 25 nautical miles, the navigator wishes to know how far he is from his home port. Discuss the solution to the navigator's problem.

5. How are vectors shown in diagrams?

6. What is the meaning of frame of reference?

7. A ship steaming south at five knots is set by a four knot current flowing in a westward direction. How much further did the ship steam to reach the same latitude than it would have if the current were not running? Assume the ship has been underway for one hour.

8. Vectors are represented by lines and arrows. What is the meaning of the length of the line and the position of the arrow?

9. It is known that the distance between points A and B are 25 nautical miles. A ship steams at an angle of 30° from the direct route between points A and B for 6 nautical miles and then turns and steams directly to B. Discuss a method by which you can ascertain the distance which the ship must steam after making its turn, in order to reach point B.

10. If several forces are acting on a given point at a given time, how can you decide upon the resultant force? Use Figure 27 on Page 18 in your text as an example.

11. If a block is located on an incline plane, the force directed down the plane is 6 newtons while the force directed in a perpendicular manner to the plane is 8 newtons. Draw a diagram of the situation and determine the magnitude and direction of the resultant force.

12. What is the relationship between $\frac{\text{OPPOSITE}}{\text{HYPOTENUSE}} = \text{SINE} \angle \theta$ and vector relationships?

13. What is the relationship between $\frac{\text{ADJACENT}}{\text{HYPOTENUSE}} = \text{COSINE} \angle \theta$ and vector relationships?

CHAPTER 2 FILMS

1. Introduction to Vectors by Martin Lewis (QA 261.L48). This is a video tape and is on reserve in the audio visual center.

2. Film loop #79, Vector Addition I: Velocity of a Boat.

3. Film loop #32, The Velocity Vector.

4. Film loop #29, The Acceleration Vector.

5. Film loop #58, Standing Waves on A String.

CHAPTER 3 PROBLEM SET

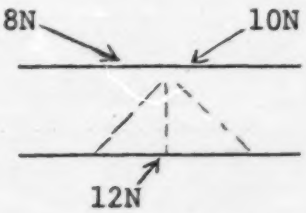
1. If three different forces act on a body, how is it possible for that body to remain at rest?

2. A body is placed upon a level plane and two forces act upon it, yet it does not move. How can this be?

3. What is the relationship between body movement and the coefficient of kinetic friction?

4. What is the relationship between body movement and the coefficient of static friction?

5. What would you expect to happen to the body in the following diagram?



6. What is the difference between force exerted on a body and force exerted by a body?

7. A 10kg ball hangs from a rope. How much force must be exerted on the ball by the rope in order that the ball will not fall to the ground?

8. What are the dimensions of force?

9. If a block is sitting on a level plane and ΣF right $\neq \Sigma F$ left, what would be expected to happen?

10. What is the meaning of ΣF up $\neq \Sigma F$ down?

11. Under what conditions would you expect to have an equivalent force?

12. If a steel block is placed upon a steel incline plane under clean conditions and under greasy conditions, is there greater change in the coefficient of static friction or in the coefficient of kinetic friction between these two conditions?

13. What happens to the coefficient of kinetic friction between a rubber tire and dry concrete as speed changes? What would you expect to happen to the coefficient under wet concrete conditions? Is there a relationship between the coefficient and accident prevention?

14. Describe the phenomenon known as plastic flow.

15. What are the meanings of the quantities in the following equations?

$f = u_k N$ $\quad$ $f_s = u_s N$

CHAPTER 3 FILMS

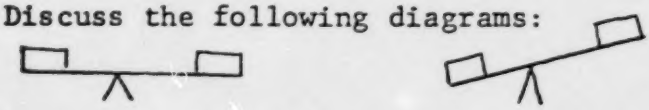
1. Film #60, Gravitational Potential Energy.
2. Film #2, Constant and Uniform Acceleration.

CHAPTER 4 PROBLEM SET

1. Define the following terms:

   a. torque
   b. equilibrium

2. Discuss the following diagrams:



3. What is a moment arm?

4. What is the relationship between torque, force applied and the distance from the axis of rotation to the applied force?

5. You are in the process of computing torque. What assumption must you make concerning the weight and the center of gravity.

6. What two conditions must be satisfied in order to satisfy the conditions of equilibrium?

7. What is the result of the following:

$$\Sigma F_{up} = \Sigma F_{down}$$

$$\Sigma E_{right} = \Sigma F_{left}$$

8. When attempting to solve problems of equilibrium, what forces must be considered?

9. The distance between the front and rear wheels of a car is 4500 mm, the front wheels support 3,000N while the weight supported by the back wheels is 3,800N. What is the total weight of the vehicle and where is the center of gravity?

10. Define the following types of equilibrium:

    a. stable
    b. unstable
    c. neutral

11. Define the following terms:

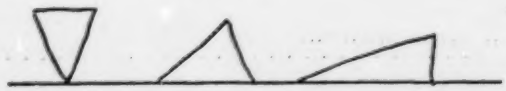
    a. thrust
    b. drag
    c. weight
    d. lift

12. What is meant by the following:

$$\text{THRUST} = \text{DRAG} + \text{WEIGHT} \times \sin\theta$$
$$\text{LIFT} = \text{WEIGHT} \times \cos\theta$$

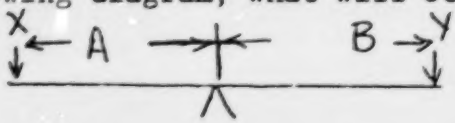
13. When is an aircraft in stable equilibrium?

14. Identify the three types of equilibria shown in the following drawing:

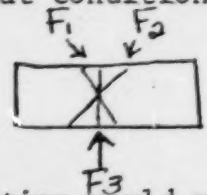


15. What type of torque is produced by verticle force and why?

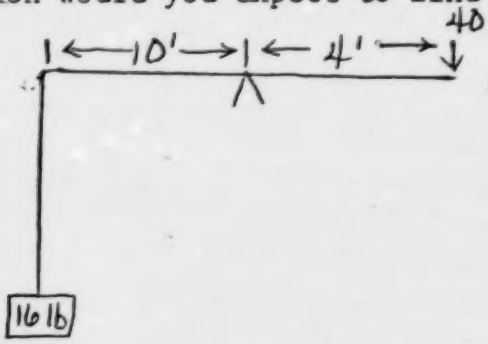
16. In the following diagram, what will occur when AX ≠ BY?



17. Under what conditions will the body shown below be in equilibrium and under what conditions will a torque be developed?



18. In what position would you expect to find the following?



CHAPTER 4 FILMS

1. Film #34, Center of Mass Pendulum.

CHAPTER 5 PROBLEM SET

1. What are two types of motion and how may they be described?

2. When dealing with velocity, what factors are of interest?

3. What is meant by instantaneous velocity?

4. What is meant by the following relationships?

$$\frac{(r_2 - r_1)}{T_2 - T_1}$$

5. You glance at your air speed indicator and see that it reads 300 knots. What does the 300 knot figure indicate to you?

6. What is the difference between instantaneous velocity and constant velocity?

7. What is another term which means time rate change of velocity?

8. If velocity of your ship through the water is 3 knots at one instant and 5 minutes later it is 23 knots, what is the average acceleration of the ship?

9. What would you expect to happen to the velocity of a ball which is dropped from the top of the Empire State Building?

10. If you were to cut a piece of paper exactly the size of a quarter, place it on top of the quarter and then drop both from waist height, which would you expect to reach the ground first and why?

11. Why does $s = Vot + \frac{1}{2}at^2$?

12. If a ball is thrown into the air on a path as shown below, what are the velocity and acceleration at point X?

13. Under what condition would you expect to have negative acceleration?

14. A projectile is fired horizontally from a gun while at the same moment one is dropped from the same height. Which projectile would you expect to reach ground first and why?

15. Justify the following statement, when a projectile is fired at an angle above the horizontal, maximum range is achieved when the angle above the horizontal is 45°. Discuss how this concept might be used in naval gunfire.

CHAPTER 5 FILMS

1. Film loop #33, Velocity and Acceleration in Free Fall.
2. Film loop #29, The Acceleration Vector.
3. Film loop #77, Acceleration Due to Gravity. Method I.
4. Film loop #78, Acceleration Due to Gravity. Method II.
5. Film loop #71, Finding the Speed of a Rifle Bullet.
6. Film loop #72, Finding the Speed of a Rifle Bullet.
7. Film loop #61, Gililean Relativity. Part I: Ball Dropped From Mast of Ship.
8. Film loop #62, Gililean Relativity. Part 2: Object Dropped From Aircraft.
9. Film loop #63, Gililean Relativity. Part 3: Projectile Fired Vertically.

CHAPTER 6 PROBLEM SET

1. What is Newton's first law and what is the relationship of this law to the findings of Galileo?

2. According to Newton's first law, what happens to the velocity of an object?

3. An airplane crashed and many people received head injuries. An investigation showed that as the plane came to a sudden stop, the people hit their heads on the seats in front of the ones in which they were sitting. How does this situation relate to Newtonian physics?

4. What is inertia?

5. What is Newton's second law and how is it related to his first law?

6. What are the dimensions of the force unit known as the newton?

7. Why is the newton called an absolute unit of force?

8. How many dynes are there in one newton and why?

9. In biology, a slug is an animal which gardners dislike but not so in physics. How is the term related to physics?

10. How is the following statement related to Newton? Forces exist in pairs, equal in magnitude and opposite in direction.

11. What is linear momentum?

12. How can Newton's second law be written in terms of momentum and what does this rewrite mean?

13. Why does a ship at anchor not move beyond the length of anchor chain which is paid out?

14. Why does a ship slow down and eventually stop once its engines are stopped (in terms of Newtonian physics)?

CHAPTER 6 FILMS

The films which apply to chapter five also apply to chapter six.

CHAPTER 7 PROBLEM SET

1. A man pushes a block of cement 10 meters over the ground. While the man is moving the block, he applies a force of 20 newtons. Once the move has been finished, what can be said about the situation?

2. What is the meaning of the following formula? $W = F_s \cos \theta$

3. What is another way of identifying a newton meter?

4. The kings foot, which was 12" long and weighed a pound when clean, moved ten feet. How much work was accomplished?

5. What is the relationship between work, tons, and miles?

6. 10 - 14 joules is equivalent to how many ergs?

7. Define the term known as power.

8. What is the relationship between the work horses are able to accomplish and the definition of work?

9. A young sailor arose early in the morning and said to a shipmate, "Boy, do I have a lot of energy". Interpret the sailor's comment.

10. A ball in a baseball pitcher's hand has what kind of energy?

11. What type of energy is possessed by a football as it flies through the air?

12. A 10^6kg ship is moving through the water at a velocity of 20km per hour. How much PE is possessed by the ship?

13. How is potential energy transformed into kinetic energy?

14. What is the relationship between force applied and force delivered in a system applying a lever arm?

15. What is actual mechanical advantage?

16. How can the efficiency of a machine be determined?

17. What is the meaning of ideal mechanical advantage?

18. What is the relationship between AMA and IMA?

19. How may we apply the concepts of simple machines to body systems?

20. How can energy be conserved if energy is required to do work?

CHAPTER 7 FILMS

1. Film loop #73, Conservation of Energy Aircraft Takeoff.
2. Film loop #39, Conservation of Energy.
3. Film loop #73, Conservation of Energy.

CHAPTER 8 PROBLEM SET

1. Define the following terms:

   a. momentum
   b. impulse

2. What is the relationship between momentum and impulse?

3. In the concept of conservation of momentum, what is the relationship between two bodies which interact?

4. What is the center of mass and how is it related to momentum?

5. With zero external force applied, what can be said about the momentum of a system?

6. What happens in a collision which is perfectly elastic?

7. A collision is seen to occur. Following the collision, the kinetic energy is found to be less than prior to the collision. What can be said of this collision?

8. What can be said of the velocity of approach versus the velocity of separation in an elastic collision?

9. What is a semi-elastic collision and how is it related to the coefficient of restitution?

10. What is the result of elastic collisions which are not head-on?

CHAPTER 8 FILMS

1. Film loop #70, Explosion of a Cluster of Objects.
2. Film loop #68, Inelastic Two-Dimensional Collisions.
3. Film loop #64, One-Dimensional Collisions, Part I.
4. Fiom loop #65, One-Dimensional Collisions, Part II.
5. Film loop #69, Scattering of a Cluster of Objects.
6. Film loop #66, Two-Dimensional Collisions, Part I.
7. Film loop #67, Two-Dimensional Collisions, Part II.
8. Film loop #36, Conservation of Momentum: Inelastic Collisions.
9. Film loop #38, Conservation of Momentum: Inelastic Collisions.
10. Film loop #35, Conservation of Momentum: Elastic Collisions.
11. Film loop #80, A Matter of Relative Motion.
12. Film loop #75, Analysis of a Hurdle Race, Part I.
13. Film loop #76, Analysis of a Hurdle Race, Part II.

CHAPTER 9 PROBLEM SET

1. What is uniform circular motion?

2. How can the magnitude of uniform circular motion be described?

3. What is the difference between centripetal and centrifugal force?

4. What is the meaning of helios centros and to whom might the original throughts be attributed?

5. What is the meaning of geos centros and to whom might the original throughts be attributed?

6. What is Newton's Law of Universal Gravitation and how might it be related to the effects of the sun and earth upon ocean tides?

7. What is the gravitational constant and how is it related to the mass of the earth?

8. What is the relationship between the weight of an object and its distance from the earth's center?

9. A weight is dropped from the top of a ship's mast when the ship is located at 0^{o} latitude and found to be 978 cm/sec^2 while it is done on another ship at 90^{o} north and found to be 983 cm/sec^2. How can this be explained?

10. Since the earth turns on its axis once in 24 hours, how is it that the time of high tide changes each day?

CHAPTER 9 FILMS

1. Film loop #31, Velocity in Circular and Simple Harmonic Motion.
2. Film loop #80, Matter and Relative Motion.

CHAPTER 10 PROBLEM SET

1. What is elasticity?

2. What is the relationship between the force applied to an elastic body and the deformation of that body and why?

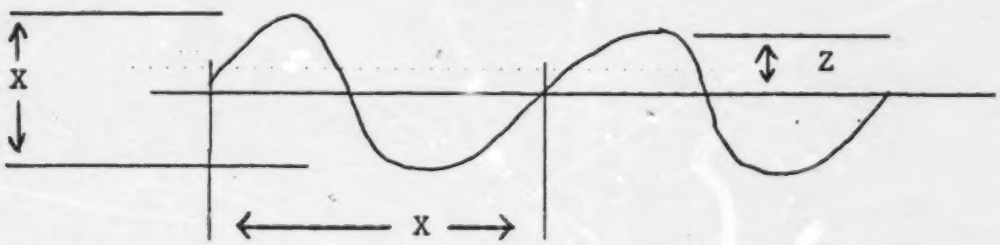
3. What is the relationship between simple harmonic motion and vibrations.

4. What is the relationship between amplitude and displacement in harmonic motion?

5. How can the period of an harmonic motion be described?

6. What is the meaning of frequency?

7. Identify each of the following:



8. What is the relationship between the period of harmonic motion and the amplitude of the motion?

9. What is meant by dampened oscillations or vibrations?

10. How are stress and strain related?

11. The relationship between original length and change in length is known as?

12. What is the modulus of stretch?

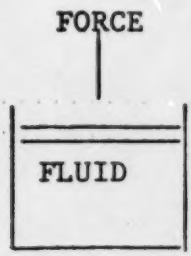
13. Define the following:

    a. permanent set
    b. ultimate tensile stress
    c. yield point
    d. deflection
    e. volume strain
    f. bulk modulus
    g. compressibility
    h. shear
    i. shearing stress
    j. shear modulus

NOTE: NO FILMS TO VIEW FOR CHAPTER 10

CHAPTER 12 PROBLEM SET

1. How can you define pressure in the following example?



2. What is weight density?

3. What is the density of a fluid whose mass is 5g and whose volume is 4.5cc?

4. If pressure increases 1 atomsphere for every 10 meters below the surface of the sea that an object moves, what is the difference in pressure per unit area when a submarine is surfaced and when it is running submerged at 1000 feet?

5. What is the relationship between Newton's third law and the ability of animals to drink liquids?

6. What is the relationship between the density of a fluid and the height it stands in a vessel?

7. What is Pascal's Principle?

8. Describe how Pascal's Principle may be used to operate the control surfaces (flaps, rudder, etc) of an aircraft.

9. What is Archimede's Principle?

10. How can Archimede's Principle be used to determine the classes of ship's hulls?

11. A 10kg mass sinks until it is half submerged in water and then it ceases to sink further. What can be said about this situation?

12. What is the relationship between the center of gravity of a boat and its metacenter?

13. In which direction does the bouyant force act on a boat hull?

14. What is the relationship between Newton's third law and the bouyant force and weight of a vessel?

15. What is specific gravity?

16. What would you expect to be the relationship between the state of matter and its density?

17. What is the difference between adhesion and cohesion?

18. What is surface tension and what would you hypothesize to be the relationship between surface tension and the ability of a liquid to evaporate?

19. What is capillary action and how is it related to the density of fluid?

CHAPTER 12 FILMS

1. Film loop #84, Floating and Sinking.

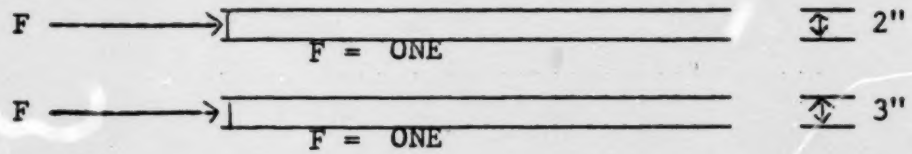
CHAPTER 13 PROBLEM SET

1. What is meant by pathline or line of flow?

2. Define the following terms:

   a. steady or stationary flow
   b. turbulent flow
   c. streamline
   d. tube of flow
   e. irrotational flow
   f. rotational flow
   g. viscous
   h. nonviscous

3. In which of the following situations would the speed of the liquid be greatest?



4. What is Bernoulli's Principle?

5. Can you hypothesize the relationship between Bernoulli's Principle and the sails of a sail boat?

6. What is the coefficient of viscosity?

7. What would you anticipate to happen to viscosity with increasing temperature?

8. Describe laminar flow.

9. In what units is viscosity measured?

10. Define the following terms:

    a. lift
    b. drag
    c. velocity gradient
    d. boundry layer
    e. dynamic lift
    f. dynamic similitude

11. What is the relationship between drag and the Reynold's number?

12. What is the relationship between pressure and viscosity?

CHAPTER 13 FILMS

1. Film loop # 74, Superposition.

APPENDIX B

GRADE CONTRACT

PS-1 GRADE CONTRACT

The course grade will be determined by contract.

1. For a grade of C, the student must pass four examinations with a grade of at least 70%.

   Examination #1 covers chapters 1 and 2; examination #2 covers chapters 3 and 4; examination #3 covers chapters 5 and 6; and, examination #4 covers chapters 7 and 8.

2. For a grade of B, the student must pass the examinations as indicated for a grade of C. In addition, the student must take and obtain a grade of at least 70% on an examination over chapters 9 and 10.

3. For a grade of A, the student must demonstrate the competencies required for grades of C and B. Further, the student must pass, at the 70% level, an examination over chapters 12 and 13. Finally, the grade of A also requires that the student complete a project outlined in the course syllabus. This project must be in the proper format and be of acceptable quality.

4. A grade of D will be awarded to the student if he fails to demonstrate at least 70% competency on any one of the C level examinations (these examinations may be taken more than once). Examination grades will not be averaged to obtain an overall 70%.

The student may up or down contract at any time prior to the last week of class during the semester.

NAME _____ DATE _____

IDENTIFICATION NUMBER _____

I wish to work for a grade of _____